

What is claimed is:

- 1 1. An apparatus for detecting the presence of crystalline material in its *in-situ*
2 growth environment, comprising:
3 a crystal growing incubator having opposing first and second sides;
4 an X-ray system, comprising:
5 an X-ray source disposed adjacent to said first side of said
6 crystal growing incubator, where said X-ray source is configured to
7 irradiate crystalline material grown in said crystal growing incubator;
8 and
9 an X-ray detector disposed adjacent to said second side of said
10 crystal growing incubator, where said X-ray detector is configured to
11 detect the presence of diffracted X-rays from crystalline material
12 grown in said crystal growing incubator; and
13 such that in use, crystalline material grown in said incubator can be screened
14 for suitability by said X-ray system, thereby, facilitating the increased reproducibility
15 of successful crystal growth experiments.
- 1 2. The apparatus of claim 1, further comprising a positioner that positions said
2 incubator and said X-ray system relative to each other.
- 1 3. The apparatus of claim 1, wherein said crystal growing incubator is a sample
2 holding tray that is configured to grow crystals therein.
- 1 4. The apparatus of claim 1, further comprising an imaging system disposed
2 adjacent to said crystal growing incubator, where said imaging system detects the
3 presence and location of crystals grown in said incubator, such that in use an X-ray
4 beam emanating from said X-ray source is accurately aligned with crystals detected by
5 said imaging system.

1 5. The apparatus of claim 1, wherein said X-ray detector is selected from a group
2 consisting of: a charged coupled device (CCD) camera and an imaging plate system.

1 6. The apparatus of claim 5, wherein said imaging plate system is a phosphor
2 plate imaging system.

1 7. The apparatus of claim 1, wherein said X-ray detector comprises a detector
2 that provides high sensitivity and a rapid readout.

1 8. The apparatus of claim 1, wherein said X-ray source emits a monochromatic
2 beam of X-rays consisting of $\text{CuK}\alpha$ radiation.

1 9. The apparatus of claim 1, wherein said X-ray source emits an X-ray beam with
2 a focus size of 200 microns or less.

1 10. The apparatus of claim 1, further comprising a transmitter that transmits
2 information associated with said diffraction pattern to a remote location.

1 11. A method of screening for crystalline material in its *in-situ* growth
2 environment, said method comprising the steps of:
3 irradiating crystalline material in its *in-situ* growth environment with
4 an X-ray beam;
5 detecting a diffraction pattern from said crystalline material; and
6 screening said crystalline material for suitability based on said
7 diffraction pattern.

1 12. The method of Claim 11 wherein the crystalline material is comprised of a
2 group consisting of: a crystalline powder, a microcrystal, a single crystal, and a
3 plurality of single crystals.

1 13. The method of Claim 11 wherein the diffraction pattern is comprised of a
2 group consisting of: a powder diffraction pattern and a pattern of X-ray diffraction
3 spots.

1 14. The method of screening for crystalline material according to claim 11, further
2 comprising, prior to said irradiating, positioning said crystalline material and said X-
3 ray beam relative to each another, such that said X-ray beam accurately aligns with
4 said crystalline material.

1 15. The method of screening for crystalline material according to claim 11, further
2 comprising, prior to said irradiating, determining the presence of said crystalline
3 material in said *in-situ* growth environment.

1 16. The method of screening for crystalline material according to claim 15, further
2 comprising ascertaining the location of said crystalline material in said *in-situ* growth
3 environment.

1 17. The method of screening for crystalline material according to claim 16, further
2 comprising storing the location of said crystalline material.

1 18. The method of screening for crystalline material according to claim 17, further
2 comprising positioning said crystalline material and said X-ray beam relative to each
3 another based on the location of said crystalline material, such that said X-ray beam
4 accurately aligns with said crystalline material.

1 19. The method of screening for crystalline material according to claim 11, further
2 comprising, prior to said irradiating, positioning said crystalline material and said X-
3 ray beam relative to one another, such that said X-ray beam can accurately irradiate
4 said crystalline material.

1 20. The method of screening for crystalline material according to claim 11,
2 wherein said method further comprises the initial step of growing crystalline material
3 in a growth environment.

1 21. The method of screening for crystalline material according to claim 20,
2 wherein said growing further comprises producing crystalline material in said growth
3 environment by a method selected from a group consisting of: a vapor diffusion
4 method, a hanging-drop method, a sitting drop method, a dialysis method, a
5 microbatch method, and a gel crystal growth method.

1 22. The method of claim 11, wherein said method is performed in space.

1 23. The method of claim 11, further comprising determining whether said
2 crystalline material is a protein crystal.

1 24. The method of claim 11, further comprising determining whether said
2 crystalline material is a salt crystal.

1 25. A method of screening for crystalline material in its *in-situ* growth
2 environment, said method comprising the steps of:
3 growing crystalline material in a crystal growing incubator;
4 placing said crystal growing incubator into a positioner;
5 determining the presence of said crystalline material in said crystal
6 growing incubator;
7 ascertaining the location of said crystalline material in said crystal
8 growing incubator;
9 storing the location of said crystalline material;
10 positioning said crystal growing incubator and an X-ray source relative
11 to each another based on the location of said crystalline material, such that an
12 X-ray beam emitted from said X-ray source accurately aligns with said
13 crystalline material;

14 irradiating said crystalline material with said X-ray beam;
15 detecting with a X-ray detector, a diffraction pattern from said
16 crystalline material; and
17 screening said crystalline material for suitability based on said
18 diffraction pattern.

1 26. The method of Claim 25 wherein the crystalline material is comprised of a
2 group consisting of: a crystalline powder, a microcrystal, a single crystal, and a
3 plurality of single crystals.

1 27. The method of Claim 25 wherein the diffraction pattern is comprised of a
2 group consisting of: a powder diffraction pattern and a pattern of X-ray diffraction
3 spots.

1 28. The method of claim 25, wherein said crystalline material is re-positioned
2 relative to said X-ray beam while said X-ray beam remains stationary.

1 29. The method of claim 25, wherein said method is performed in space.

1 30. The method of claim 25, further comprising determining whether said
2 crystalline material is a protein crystal.

1 31. The method of claim 25, further comprising determining whether said
2 crystalline material is a salt crystal.